FRIENDS *and the* WORLD *of* NATURE

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"The rift between man and nature," he writes, "became abruptly clear to me the day I heard of the bombing of Hiroshima. I almost gave up plans for a scientific career at that time. This pamphlet arose during a sabbatical period spent at Woodbrooke College in England where I sought for Quaker insights that would allow men and women of our time to break through to a more harmonious communion with nature, our environment, the scientific community, and the world of industrial production."

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TO MY MOTHER

LOTTE BENFEY

On Her Eightieth Birthday

> It would go a great way to caution and direct people in their Use of the World, that they were better studied and known in the Creation of it.
>
> For how could Man [kind] find the Confidence to abuse it, while they should see the Great Creator stare them in the Face, in all and every Part thereof?
>
> WILLIAM PENN, SOME FRUITS OF SOLITUDE (1692).

WHAT I have written in these pages is addressed especially to those who like myself feel distressed that science is still generally seen as mechanistic, atomistic, particulate, without deeper meaning. What is needed, I increasingly feel, is a new way of looking at nature, releasing the energies of those who in fact do look at nature in non-"orthodox" ways but are shackled by the fear that they may be wrong and that few believe as they do. What follows is in the form of a meditation on our manifold relations to nature.

I

Of course inanimate nature, that part of nature most easily thought of as made of atoms, cannot be totally unlike ourselves. According to the doctrine of evolution, inanimate nature is merely an early stage of ourselves. The only sound way to hold to the particulate, mechanistic doctrine is to insist that we also are mere particles in motion, a machine which is part of a larger machine. Not only Friends, but all those who have looked into themselves know they are aware of something that is not machine-like—the experience of mutual love, the longing, caring love for a child or a friend, the experience of awe, the sensing of greatness in another, the feeling that comes at times when one is lifted out of oneself on listening to a piece of music or contemplating a work of art or reading a piece of poetry that suddenly speaks to one's condition.

The suffering of countless today is a spiritual suffering, a feeling of being shackled by a fragmented, fractured worldview, the pieces scattered yet wailing that they belong together. And we have lost the art or the interest in putting the pieces of puzzles together, or else feel inhibited in trying to do so. We have been told too often that what distinguishes the alchemist from the chemist, or the Medieval from the modern scientist, is that the former insisted on a total worldview, his religion and his view of nature harmoniously fitting together, whereas modern science is less ambitious, it has greater humility, it is satisfied with discovering the laws of behavior operating in a small part of nature, without needing to be sure that its connections with other parts of nature and experience are secure. That renunciation was a noble gesture and that humility has taken us far and could take us further. But unfortunately humility has largely given way to dogmatic certainty that what has been found in parts of nature is the pattern of all of nature, and what in the life of the spirit is not consonant with it is an illusion.

And yet I would maintain that few who go into science do so with the attitude that what they are committing their lives to is the further understanding, manipulation and use of a totally senseless collocation of atoms which, purely by chance, *and* because of the character of the initial atomic building blocks, happened, in the aeons of time through the process of evolution, to produce *us* and the world *we* find ourselves in now. But notice what I suggested was needed in addition to time and the laws of chance—a particular very unusual set of building blocks, of atoms, of particles. And who endowed the atoms with the particular properties we claim they have? *We* did, the scientists of the last two centuries, who have tried to explain man and nature using only those atoms and chance and time. Any atoms which, when thrown into the arena of the big bang, did not produce what in fact was produced were discarded or held in abeyance or held onto with embarrassment until a collection of atoms was proposed with a more congenial set of properties. Those atomic properties must satisfy severe requirements, for nowhere in the long process of evolution from that distant beginning to our own day may

non-scientific, non-natural interventions take place. All that takes place must have been foreordained by the conditions existing when the whole process began. It is we human beings who have made our demands on the scientific community, that if scientists begin with a scientific description, they may not, when things become difficult, resort to God to carry the process over the gulfs of non-comprehension, of ignorance. God is not to appear at certain moments of evolution to breathe life into the first amoeba nor to endow the first human with a soul. All of God's handiwork—if God was there at all—must have gone into the original design.

At an earlier age—around the time of Newton and Laplace—many thought of God as the great clockmaker and winder-up of the universal clock, which since then, without his help has been running down. The newer view would think of God as establishing the initial conditions at the time of the big bang and of creating the initial particles, to be thrown out and fused and fissioned in the first seconds of our evolution. But this newer view, though it could be stated in quite parallel terms to the clockmaker analogy, is seldom stated in this way because the proponents of the cosmic evolution view are normally not interested in bringing God into the picture even at the start. Thus the initial conditions just were as they were, including the atoms with their strange and marvellous properties—and that is the way we were made, how we came to be. It is meaningless to ask what was happening before time began, before the big bang, and St. Augustine already had an answer for those who insisted on asking such questions—that God had prepared a special place in hell for such people.

But it is one thing to ask what was going on before God created the world, a quite different one to account for a given set of particles and conditions which just happened to appear at a moment about 15 billion years ago when time and change are supposed to have begun. The current evolutionary view is not complete, not because it hasn't yet filled in all the moments between then and now, but because its initial description demands an act of faith from us and we have never yet been asked to commit ourselves to anything remotely

resembling this present claim. It is one thing to accept expert advice that it will probably rain tomorrow or that the design for a new bridge is sound—on the word of those who have devoted their professional lives to the understanding of the phenomena they speak about or the construction of the devices they are proposing. It is a very different proposition to accept a description of the state of the universe at time zero, and the nature of the laws operating on the materials and energies present, purely on the basis of its consonance with the current practice of science, when the conclusion is that there is no meaning explaining the initial conditions and hence no meaning, no significance, to our own lives either.

Such a view at any other period of history would have been labelled as patently absurd. But since the theological establishment is in disarray and there are no self-evident truths acceptably originating from that camp, we are afraid to say no to a coherent viewpoint that at least ties together all the sciences even if it plays havoc with our conception of ourselves, our sense of our significance, our own importance. Perhaps the call of the scientist to us is a further step in our own humiliation—or stage on the road to humility. Perhaps we are just dust and ashes—we can find scriptural passages to support such a conclusion.

For a while we had thought that evolution at least had a direction, that it was moving either to a point or at least to a region with a higher value than the present or the past. But even before that view was exploded by the scientific establishment, it was clear that scientific evolution could not be tied to progress, because there was no *telos,* no end in time. If we only reach the end—any end—at infinite time, then no matter how far we move in its direction, we shall always be an infinite distance from the goal. No progress has measurable significance on a time scale immeasurably long.

II

Those who are not scientists seem to assume that all the men and women in white lab coats who are manipulating computers, or staying up nights to contemplate the galaxies, or peering down microscopes to study the teeming life in a drop of water or the colors and geometric patterns of illuminated crystals, are committed to a view of nature that is nothing but particles linked or in motion. Where that notion originated is not hard to determine. Most scientists are too busy doing science to attempt to publish for the general public their feelings and thoughts about the piece of their environment they are measuring, dissecting, watching. But there have been a few courageous or cocksure or fool-hardy individuals who have proclaimed what they felt was the necessary scientific viewpoint that has grown out of the findings of science to date. It was easier to do when modern science was young, when new discoveries poured like an avalanche into the awareness of those who were asking new questions. Those early answers more and more fitted the view that in order to understand nature we had only to believe in a set of particles moving as described by Newton's laws of motion. Particles had no color, for color was simply the effect produced when certain particles stimulated the nerve endings in our eyes. Nor had they smell, for that was due to impact of particles inside our noses, nor was sound inherent in nature, nor of course did the particles have a soul, an intention, a purpose. They were totally unlike us—for we could examine them and feel them and taste them and be nourished by them, but they could do none of those things.

By 1700 the possibility arose that *all* was simply particles in motion, for that simple view explained the tides of the oceans, and the fall of an apple, and the movements of the planets around the sun. Laplace, some decades later, raised the possibility that if all was particles, and their laws of motion were known, their future locations would be calculable from their present situation, there could be no freedom, no deviation from whatever is built into the configurations, speeds and directions of the atoms at this moment

now. Not only that, but the past could be calculated from the present in complete detail. All has happened as it had to happen, we are part of a clockwork mechanism running up or down, but in any case running, uninfluenced by anything we might want to do about it.

Many people know that this simple view can no longer be held, that relativity and quantum theory and the Heisenberg uncertainty principle have emerged, but it is not clear how these have fundamentally changed the basic view that nature is dead and unfeeling and soulless, a senseless collection of somethings obeying laws quite other than those we feel motivate us.

Non-scientists, as I have said, feel that the above is approximately how scientists think about nature and they have a lurking suspicion that anyone who feels that nature is mechanical, unfeeling, soulless, must himself be similarly soulless and devoid of the nobler emotions. I have begun to wonder how many practitioners of science do in fact view nature in this way, or have viewed it so in the past.

I think of Kepler who thought of nature not as a dance of aimless atoms but rather as the handiwork of a divine mathematician whose thoughts it was possible for men to think after Him through careful attention to the behavior of nature.

I think of chemists most of whom, as we shall see, were not atomists until our Friend, John Dalton, around 1810, showed how atoms could be useful in chemistry. I think of the naturalists of the eighteenth and nineteenth centuries, men like the Friends John and William Bartram who lovingly described the flora of North America and sent specimens to John Fothergill, physician and scientist in London, to plant in his garden for enjoyment and study. These men and women were not concerned with the ultimate constitution of matter, whether particulate or otherwise. They were describing, classifying, and investigating the living beings of nature among which they found themselves and among which they felt at home.

The group of geologists of the late eighteenth century known collectively as Catastrophists sought to prove by their observation of rocks and landscapes that natural science could be a powerful vehicle for confirming the doctrines of the Bible. Abraham Werner

sought to prove that the earth had experienced a series of catastrophes of which Noah's flood was the last. However, those who disagreed with Werner, the Plutonists and Uniformitarians such as James Hutton, were not Newtonian mechanists either. James Hutton believed, in fact, that the earth was a great organism preserving some kind of balance, that while some mountains were being raised up in one part, elsewhere others were being eroded and washed away.

There were far more naturalists and geologists around than there were physicists and astronomers. Only the latter group were facing in their work the possible implications of the mechanistic laws they were discovering.

A major motivating force behind those devoting their professional life to the study of animal behavior must be the delight and fascination in simply watching the life patterns before them. A belief that what was delighting him was simply his subjective response to the impacts of a chance collection of atoms would scarcely sustain a scientist's interest for long.

Max Weber's *Protestant Ethic and the Spirit of Capitalism* and R. H. Tawney's *Religion and the Rise of Capitalism* have pointed to the change in religious atmosphere which led a remarkable number of religious dissidents—Puritans, Quakers and others—to flock to the sciences and make significant contributions to them. There are some negative reasons for this: The prevailing judgment that music, art and drama were wicked since they let loose the emotions, and that they were unworthy of the time and attention of the God-centered man, left little room for relaxation and the exercise of feeling outside the realm of prayer and church assemblies. Friends were in fact advised by William Penn to find their recreation in nature. Secondly the dissenters were excluded from Oxford and Cambridge, the only English universities of the time, and were thus largely denied access to the professions of medicine and the law (unless they went to Edinburgh or the Continent or apprenticed themselves to apothecaries or physicians or were converted to their dissident faith after completing their university training). Those of

intellectual bent were thus strongly attracted to the new stream of study and discussion open to them, the experimental study of nature. It is most unlikely that anyone would have followed that path, deeply committed as they were to a religious view of life, if they countenanced even the possibility that the truths of science were totally unlike the truths of the spirit, that they might in fact lay spiritual insights open to question.

III

The seventeenth century saw not only the great Puritan hurricane engulfing England, it saw also a modified Platonism, neo-Platonism or Christian Platonism, entering the British Isles along with a warm humanism, an affirmation of man and nature. Renaissance paintings glorify the natural world, they give the impression that the painters had just discovered nature.

Rufus Jones has described in his many books on mysticism the slow ascendancy of the positive, life affirming, outer-directed mystical teaching as against the *Via Negativa*, the way to union with God via self-denial and separation from all that represents the common life of mankind. Whatever is the final outcome of the intense arguments within Quakerism regarding the prophetic as against the mystical character of the early Quaker movement, it is perfectly clear that Friends were not called out of the world, that they were not asked to deny it. The only justification for withdrawal was as preparation for intensive work *within* the world, and there again not only to save individual souls, but to transform the world, to work towards the establishment of the kingdom of God on earth.

This neo-Platonism sought for a new view of the world not grounded in pagan Greek thought but transformed by the insights and experience of Christianity. On that pagan view the material was considered as bad or at least as on a lower level than spirit, a level to move away from as enlightenment grows. Hence came the ancient justification of slavery, based on the conviction that it was unworthy

for the enlightened man to do manual work, which nonetheless has to be done so that he may continue his heavenly quest.

Christianity on the other hand helped to *raise* the significance of matter and of working with materials. Jesus was a carpenter, and there is no hint that on taking up his ministry he renounced or condemned his former calling. He is seen as the Word made Flesh, not taking on simply the appearance of man but being fully man as he was also fully God, thus in his person uniting the material and spiritual. According to classical Christian doctrine, his body was transformed—so that the physical body was missing (though the graveclothes were still there) and a new body emerged, convincing to Thomas' touch yet able to go through closed doors and capable of being taken up out of sight on the day of ascension. Christianity clearly has a doctrine of matter quite apart from its new insights about man and sin and rebirth and man's relation to God. The sacraments preach this new doctrine—either that the bread and the wine transform themselves into the body and blood of Christ in the hands and mouth of the believer, or else that they are the outward and visible sign of an inward and invisible grace, that material objects in certain circumstances become vehicles for transmitting transforming energy and grace to those open to them. Quakers did not deny this doctrine; they universalized it, or rather, re-universalized it, assuming that the original form of Christianity already held to this conviction. Friends warned against the dangers of forms that had become empty, of rituals believed by magic to improve a man's lot or his status in the final judgment. They held that all matter was sacramental, not certain bits at certain times. George Fox in one of his epistles insisted that he was not against all forms, only against empty forms, that nature itself was a form.

Fox was grappling with the question of the deeper meaning of nature as early as 1648:

"One morning as I was sitting by the fire, a great cloud came over me, and a temptation beset me; and I sat still. It was said, 'all things come by nature;' and the elements and stars came over me, so that I was in a manner quite clouded with it. . . . And as I sat

still under it and let it alone, a living hope and a true voice arose in me which said, 'There is a living God who made all things'''[1] and thus by implicaton all things should reveal the character of their maker.

IV

With John Woolman, who lived from 1720 to 1772, a new mood enters the mainstream of Quakerism. One finds little like it in the writings of early Friends. Ralph Waldo Emerson (1803–1882), who admired George Fox greatly and wrote in detail about him, yet placed John Woolman's *Journal* even higher: ''I find more wisdom in these pages than in any other book written since the days of the apostles.''

Here are two quotations from John Woolman's ''Plea For the Poor'':

> Our Gracious Creator cares and provides for all his Creatures. His tender mercies are over all his works; and so far as his love influences our minds, so far we become interested in his workmanship, and feel a desire to take hold of every opportunity to lessen the distresses of the afflicted and increase the happiness of the Creation. Here we have a prospect of one common interest, from which our own is inseparable, that to turn all the treasures we possess into the channel of Universal Love becomes the business of our lives.[2]
>
> The Creator of the earth is the owner of it. He gave us being thereon, and our nature requires nourishment which is the produce of it. As he is kind and merciful, we as his creatures, while we live answerable to the design of our creation, we are so far entitled to a convenient subsistence that no man may justly deprive us of it.[3]

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[1]*The Journal of George Fox*, ed. and intr. Rufus M. Jones, essay by Henry J. Cadbury (New York: Capricorn Books, 1963), p. 94.

[2]*The Journal and Major Essays of John Woolman*, ed. Phillips P. Moulton (Oxford University Press, 1971), p. 241.

[3]*Ibid.*, p. 239.

John Woolman appears to me like a figure in a Chinese painting. He places himself perfectly proportioned in his natural surroundings, drawing our attention more by his being human as we are rather than by any exaggeration in size. He believed that the intention of his creator was that man can and should live in harmony with his environment, that God was expressible in the image of love and therefore the business of our lives should be more and more to channel all that we possess into the channel of universal love. And by possessions he had in mind our physical treasures no less than our endowments and gifts of character, for he sought in his purchases and material activities to support all that was good and to cause no suffering to others. The material and how it was used were to be vehicles for God's love. He points out in the second quotation that we can only exist by obtaining nourishment and since God has placed us here and is kind and merciful we are entitled to our "convenient" share of sustenance "that no man may justly deprive us of it." What a marvellously succinct statement of our inextricable conjunction with the material world, and the social doctrine that in a just society no man shall have excess food if thereby others go hungry.

Whence comes this sense of the ideal harmonious interaction of man and nature, of nature as beneficent, as being designed at least in part to supply man's need, to be the vehicle for God's bounty? Phillips P. Moulton, in the introduction to his new edition of John Woolman's *Journal,* lists some of the books Woolman read, some of the influences on his life. In addition to several Quaker classics, Moulton lists the writings of non-Quaker mystics read by Woolman—*The Imitation of Christ,* Jacob Boehme, John Everard and William Law.[4] Now these were all in the neo-Platonic tradition, Christian Platonism fusing Platonic philosophy with Christian insight. In particular the last three tended to break with the older mystical tradition of seeking God by severing yourself totally from

[4]Moulton obtained his information about Woolman's reading from Walter Forrest Altman's "John Woolman's Reading" (Florida State University, June, 1957), made available by University Microfilms International.

this world, the *via negativa,* and instead saw in nature the manifestation of the divine and began to see an active role for the God-centered man in the affairs of the world. The relation of the physical and the spiritual world is succinctly expressed by Boehme who lived just prior to the birth of the Quaker movement, from 1575 to 1624: "The visible world is sprung from the spiritual world . . . it is a subject or object resembling the spiritual world: the spiritual world is the inward ground of the visible world; the visible subsists in the spiritual."[5]

Moulton says that Boehme was already read by George Fox, his writings becoming available in English in the 1640's. Moulton also asserts that the Behmenist (or Boehmian) societies that arose during the seventeenth century "eventually merged into the Quaker movement," a statement appearing also in the 1947 *Encyclopedia Britannica* article on Boehme. Regarding the early period of Quakerism, direct contact with neo-Platonism is a matter of intense controversy among Friends. What we do know is that neo-Platonic thought was sweeping through England during the 1640's. John Punshon, Woodbrooke Director of Quaker Studies, has characterized part of the new mood as a reawakening of the expectation of an outpouring of the Holy Spirit. The era of revelation by Jesus through the Church was to be replaced by a direct communication between Christ and his followers through the third person of the Trinity, the Holy Ghost, Christ in us.

I would like to suggest that the new doctrine about the material world, although it was part of this expectation of the imminent transformation of the earth and its people into the kingdom of God, did not enter the consciousness of early Friends to a great extent. William Penn did advise Friends to appreciate nature and George Fox, in setting up schools, recommended the study of plants and herbs for their medical uses. But largely Friends were concerned

[5]*The Works of Jacob Behmen with Figures illustrating his Principles left by the Reverend William Law,* 4 Vols. (London 1764). The quotation is from the "Clavis" at the end of Volume II, p. 18.

with the relations of man to man and to God. The era of persecution left little room for contemplating man's relation to the material world, except in the negative way of learning to live unencumbered lives—our testimony of simplicity.

Boehme, as Rufus Jones has emphasized, was interested in alchemy (as Newton was later, influenced in part by the Cambridge Platonists, another neo-Platonic group). The alchemists, under the influence of Paracelsus, were turning from seeking the elixir, that would allow you to live for ever, to the search for medicines to cure human afflictions. Alchemists had always believed that careful study of the transformations possible in the laboratory would provide hints of the transformations of which man's soul is capable. Thus the alchemical process of purification, seeking to convert base metals into gold, had its parallel in the purification of the soul. The two went hand-in-hand and only the pure in heart could succeed in the alchemical work. During that period, the sixteenth and seventeenth centuries, arose the "Chemical Philosophy," an attempt to rewrite science, the description of nature, in a new Christian form rather than the mechanistic, atomistic directions that were being developed still based on Greek and therefore pagan patterns.[6] The Christian revelation had brought a new view of matter and because of that there was need for a new scientific viewpoint. Yet, as we know, this attempt was not successful. It was submerged by the success of Newton's mechanics and the 300-year long attempt to look at all aspects of nature from a mechanical viewpoint. Only now has the inadequacy of that approach become clearly evident and a search is on for a more adequate view of nature. Now we need to look again at what the Chemical Philosophy was attempting to create.

Most chemists were not atomists until our Friend, John Dalton, around 1810 showed how atoms could be useful in chemistry. To Dalton, as for Newton, the atoms were the ultimate, eternal, uncuttable building blocks which by their patterned clustering with other

[6]Cf. Allen G. Debus, *The Chemical Philosophy*, 2 Vols. (New York: Science History Publications, 1977).

atoms produced the glorious diversity of materials in our being and in our surroundings. Newton put it this way:

"It seems probable to me, that God in the beginning form'd Matter in solid, massy, hard, impenetrable, movable Particles, of such Sizes and Figures, and with such other Properties, and in such Proportions to Space, as most conduced to the End for which he form'd them; and that these primitive Particles being Solids, are incomparably harder than any porous Bodies compounded of them; even so very hard, as never to wear or break in pieces; no ordinary Power being able to divide what God himself made one in the first Creation."[7] Strange that a Quaker, John Dalton, should be the agent for the chemists' conversion to a thoroughly particulate, atomistic viewpoint. Dalton loved nature and observed it minutely. He recorded daily weather measurements throughout his life. Why should a Quaker open the door to a development so destructive, for a time, of religious concerns?

It is not the only time Quakers have opened the door to developments whose consequences were not at all in line with the deepest Quaker longings. Abraham Darby and his descendants found a way of using coal (via coke) so abundant in England for the smelting of iron ore. Iron production had come almost to a standstill in England because wood was being used till then for making charcoal which was the only effective means for making high quality iron from iron ore. To save the remaining forests of England, its iron was largely imported from the continent. The Darbys' invention is generally considered to have ushered in the Industrial Revolution. The first iron bridge constructed in the West was cast in 1779, just two hundred years ago, and was erected across the Severn in Shropshire in the community now known as Ironbridge. Kenneth Boulding in his 1970 Swarthmore lecture suggests that "in terms of sheer quantity of influence it may well be that Abraham Darby of Coalbrookdale was the most influential Quaker in three centuries." His work led to the mammoth steel works of the Midlands, the Ruhr and

[7]Isaac Newton, *Opticks* (1704)—part of the last Query.

Pennsylvania. He adds that "the economic base for the great upsurge of English-speaking peoples in the last two hundred years owes a great deal to the hard work and ingenuity of the eighteenth-century Quakers in advancing science and industry.... More traditional cultures, which have not been able to adapt to it, have been destroyed or perverted by it, including the culture of traditional Quakerism." Yet Kenneth Boulding points out that this was "a movement which rests on the discovery of truth; truth, especially, about the physical and biological systems of the world."

Could one hazard the suggestion that Quakers by not being tied to a fixed, closed system of truth, organized their Society and their life on the confident belief not only that new truth will continue to be revealed, but that all truth is good and new truths will enhance and enlarge the understanding of truths already known? Others, less optimistic, would hesitate before throwing their lives and their fortunes into new directions of knowledge and human activity, but Friends (though usually avoiding destructive activities and explorations) assumed all (neutral) openings to be good.

There is a third Quaker who stands as a doorkeeper opening a door to a new—and in this case even an avowedly destructive—world. John U. Nef in his *War and Human Progress,* a masterly study of the attitudes of scientists to the improvements of the arts of war, points to our Friend Benjamin Robins (1707–1751) as one of the first English natural philosophers to "combine with a good conscience speculative scientific work and practical engineering for destructive purposes." He was a mathematician, a Fellow of the Royal Society, who turned his genius to the study of projectiles and of military engineering. His *New Principles of Gunnery* (1742) marked a milestone in military history. In it he criticized Newton and Galileo for not testing their theories in the field. Though Robins left the Society of Friends in his early twenties, he did not sever all ties with his former religious community. He is known to have remained in close friendship with many Quakers throughout his life and to have been on very close terms with his father who outlived him. Whereas Renaissance scientists had feared the evil tendencies in man and

refused to divulge particularly fiendish inventions (examples are Leonardo's design of a submarine and an explosive device of John Napier of logarithm fame), Robins and those who followed him into the era of the so-called Enlightenment felt that the world could only gain from *all* new truths. The *Dictionary of National Biography* reports that Robins "was always ready to communicate to others the results of his studies and labors"—although it is doubtful that he was willing to divulge the details of the fortifications of Madras which he designed and developed.

Here then are three Quakers at the pivotal points of historical movements: John Dalton establishing the particulate conception of chemical change, Abraham Darby working out and exploiting the key invention that supplied iron in almost unlimited quantities, and Benjamin Robins bending his scientific knowledge to the perfection of the arts of war. Only total blindness or else sublime optimism can account for these three—and the general enthusiasm of Quakers for scientific and industrial progress. I am convinced there was much more optimism than blindness underlying their enthusiasm. They could not possibly foresee the destruction of the environment, the slaughtering of millions in modern war, and the total undermining of faith that might result from progress in industry and science. And they had faith that there would always be enough individuals sensitive to God's will to prevent that progress from leading mankind as a whole to destruction.

VI

The consciousness of the need to forge a doctrine of the material world may have been the contribution of American Friends to Quaker thought. John Woolman must have been deeply influenced by neo-Platonic ideas regarding the material world for there was little in his Quaker reading to help him. This does not seem to have been a personal idiosyncracy on Woolman's part, for his records show that a book of his by the seventeenth century neo-Platonist and mystic John Everard was borrowed at least seven times by others.

Furthermore, Reginald Reynolds in his studies of John Woolman has come to the conclusion that John Woolman was not alone in his concerns, that there was a group of influential Friends sharing his outlook, of which he mentions three—Joshua Evans, John Hunt and Anthony Benezet.

It is thus plausible to suggest that Rufus Jones learned of the mystical tradition within Quakerism through the awareness of the mystics by American Friends during the Quietist period. Rufus Jones may have assumed it was equally strong among early Friends, though he was quite aware of and explicit regarding the lack of conclusive evidence.

But John Woolman's influence extended beyond Friends. His influence on Emerson I have already indicated. Yukio Irie, in his *Emerson and Quakerism,* shows in some detail how Emerson came to many Quaker positions. He even said of himself that he was "more of a Quaker than anything else" and his decision to resign from his position as a Unitarian Minister as well as his criticism of the way he was expected to administer the Lord's supper were almost certainly strongly influenced by what he knew of the Society of Friends.

Emerson had an enormous influence on nineteenth-century American thought. Thoreau lived on Emerson's land while writing *Walden,* a practical attempt to relate man and nature in line with Emerson's principles. Emerson's first major publication was called *Nature.* In a later essay with the same title he calls on us to "make friends with matter. . . . As water to our thirst, so is the rock, the ground, to our eyes and hands and feet." He was thus concerned to change our relations with inanimate matter as well as with animate nature, the plant and animal world.

According to the 1962 *Encyclopedia Britannica* article on Emerson written by Sherman Paul (who had previously written a book with the revealing title *Emerson's Angle of Vision: Man and Nature in American Experience*), Emerson felt unsettled and paralyzed by the mechanical conception of the universe and the corresponding psychology of sensation of John Locke. There was "no place for the

piety and spirit of the Puritans in that machine-like world of matter in motion.'' There was no place for free will. Men became victims of circumstance. Emerson's *Nature* ''put nature once more at the moral service of man.''[8]

Emerson found kindred spirits in Carlyle, Coleridge, Goethe and Swedenborg (and he also read Boehme and writings of the Orient!) Carlyle had written at length about George Fox, while Coleridge had said of Woolman's *Journal*, ''I should almost despair of that man who could peruse the life of John Woolman without an amelioration of heart.'' Goethe had confronted Newton head on, denying that white light was a mixture of colors, and challenging the whole mechanistic, analytical approach to nature. He wrote his *Color Theory* as an alternative approach to the study of nature and was fascinated by the recurrence of certain patterns throughout nature—at many different levels of complexity. This organization on the basis of closely similar pattern later helped the organization of species on a time scale—the theory of evolution.

The *Britannica* article continues that Emerson's generation was ''determined to vindicate America by building a culture better than that of the old world . . . that generation needed a philosopy that would not only help to overcome the servility to tradition but teach how to use the ever-new materials of life—the resources of nature. This Emerson provided.''

In a lecture on the ''American-ness of American Technology''[9] given during America's 1976 bicentennial celebrations, the historian of technology Eugene Ferguson pointed out that the motivation for American industrialization was far more than mere wealth, profit, comfort, and the subjugation of matter. It was the dream that through the right handling of materials a humane standard of living could be provided for all citizens, making unnecessary a slave or servant class. It was part of the democratic dream and the only way democracy can be actualized. Similar motivations must have been

[8] Vol. 8 (1962), p. 392.

[9] Since published in *Technology and Culture*, 20, I (1979), 3–24.

present in the Darbys and in George Cadbury of Birmingham who devoted his life to creating a humane environment for the workers in his chocolate factories and was instrumental also in the founding of England's Quaker study center at Woodbrooke.

Howard Brinton's preface to Irie's *Emerson and Quakerism* (based on studies at Woodbrooke and Pendle Hill) picks up on the prevalent materialism of our time. "Emerson's doctrine that God is present in all events in nature did not degenerate into a philosophic pantheism, but was similar to the Quaker belief which led so many Quakers into scientific pursuits for the reason that the works of God, both within and without, reveal the operations of His Spirit. Every poem of Emerson . . . is inspired by a perception of correspondence between something in nature and something in spirit.

"To many persons today who are under the strong influence of mechanistic science and who are pessimistic about the future, Emerson seems out of date. Perhaps it was the rise of mechanistic science which contributed to the decline of the Society of Friends in the nineteenth century and the retreat of many Quakers to pre-Quaker Protestant practice and authoritarian theology . . . signs are multiplying . . . that man, disillusioned by the extreme danger in which mechanistic science and the meaninglessness of life which it creates has now placed him, is seeking for some deeper, more moving and more spiritual power to give direction and goal to his life. . . . Emerson, accordingly, has more to say to the coming generation than to its predecessor."[10]

VII

Kathleen Lonsdale (1903–1971), the distinguished twentieth century Quaker crystallographer, one of the first two women to be elected a Fellow of the Royal Society (1945), and first woman to be President of the British Association for the Advancement of Science (1968), could state quite dogmatically on behalf of Friends generally

[10] Tokyo: Kenkyusha, (1967).

that they did not hold the view of science and nature so generally believed to be the view of all competent scientists:

"Friends do not accept the idea that the universe occurred by chance, that man is a chance conglomerate of molecules which has developed ideals, a conscience, humanitarian instincts merely in order to survive. That seems to make a god of chance and to attribute motives to a machine. It is wholly incredible. . ."[11]

How could Kathleen Lonsdale generalize thus, beginning with sublime confidence that "Friends do not accept" and ending with "it is wholly incredible"?

Another expositor of Quaker beliefs, Harold Loukes, can state categorically that "The central element in the whole Quaker position is that spiritual laws are material laws as well: They are the laws of the universe."[12]

At first such a claim seems preposterous and hard for a scientific age to swallow. But if we understand spiritual laws the way an agnostic must, as laws of the highest capacities humans are capable of, then the statement almost becomes self-evident, for the material world and man are part of the same evolution.

What we must beware of, as I have indicated earlier, is the bland reductionism, the "nothing but"ism which concludes that man's capacity for love, his most creative endeavors, are nothing but the result of senseless particles carrying out Newtonian laws. The atoms of modern science are very sophisticated entities which do not obey Newton's laws but rather fit into relativistic quantum mechanics, a statement I make here only to point out that these atoms are not easy to comprehend, they are most difficult to grasp. And no one has yet attempted to use them in order to understand man's creation of works of art and his sense of awe and desire to worship. When that time comes, no doubt the atoms will be endowed with even further properties, made requisite by the new areas of reality they are called on to explain.

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[11] *Science and Quakerism*, Friends Home Service Committee (London, 1956).

[12] *Friends Face Reality*, Bannisdale Press (London, 1954), p. 148.

Some years ago I pointed out the gradual transformation, largely unnoticed by the scientific community, of the fundamental particles, atoms, molecules from being simply initial building blocks, to becoming more and more like little organisms.[13] Take the case of the atom described by the Quaker John Dalton which is still the instinctive image most people have of atoms, though many of them know perfectly well that science has fundamentally modified this view.

In the course of chemical and physical research we have found that almost every criterion Dalton used for characterizing his atoms has had to be modified. We now know that his atoms are not uncuttable, they have their own structure, that atoms of the same element are not all alike, nor are those of different elements always different in weight. They have "affections" both specific and limited. Oxygen will combine readily with copper but not easily with gold or platinum. When oxygen and copper combine, the copper will take on about a fourth of its weight of oxygen but then it stops and will utterly refuse to take more. But above all we have learned that atoms are not eternal, that they can be bombarded and splintered into smaller atoms and fused into larger wholes. Oxygen atoms did not exist at the first big bang, they were born at a certain moment of time when the temperature had cooled enough to allow their existence, and many of them were later incorporated into larger atoms, such as sulfur. Thus any given atom can have its life history, its obituary written, from the time of its birth, through its period of active involvement in molecular society, to its final demise either by disintegration or absorption into something larger. Where is the fundamental difference between it and what we describe as organisms? They too have an inner structure, are born, live out their existence in their relation to other organisms of the same size as well as smaller and larger ones, and end their identity by decay and disintegration or by absorption into something larger than they.

Alfred North Whitehead sensed this emerging view of science, developing his philosophy of organism around it. He suggested that

[13]O. T. Benfey, *J. Chem. Educ. 34*, 286 (1957).

physics and biology differ only in this, that biology is the science of large organisms while physics deals with organisms of smaller size.

One can analyze the concept of the molecule the same way, as well as many other building units of sciences. One can analyze whole fields of science and their development. An example is the attempt to describe the behavior of gases as due to particles freely moving in space. The initial concepts usually look mechanical, particulate, dead, but the initial concepts do not explain actual nature too well. As the theories are modified they become more successful descriptors, and at the same time they more and more describe little organisms, time-dependent entities—rather than Greek eternal atoms or machines.

VIII

Joseph Needham, biochemist, Fellow of the Royal Society and author of the monumental *Science and Civilization in China* has pointed to the impressive contributions made by the Chinese over the centuries both to pure and applied science and to technology. Their major work in these fields occurred before our Renaissance, at a time when both East and West thought of nature in organismic terms, thinking of stones, for instance, as having intentions, aims. The West, Needham points out, then switched over to a worldview based on mechanism but is now returning by its own discoveries and reflections to a view that sees the phenomena of nature by analogy with our—now refined—knowledge of organisms.

The Chinese made remarkable progress in science and technology before 1500 on the basis of their Yin-Yang concept of alternating and complementary phases, supplemented by a cyclic view of five elements (or phases), earth, metal, wood, fire and water. The fact that progress in the understanding and manipulation of the material world can occur using two such diametrically opposed philosophies of nature, one particulate and analytical, the other continuous, with everything influencing everything else, suggests that the atomistic-mechanistic viewpoint of the last three hundred years need not be

the final one or even close to truth. Many different viewpoints still allow the successful organization of information we obtain from the material world around us.

Herbert Butterfield in his *Origins of Modern Science* discusses the advent of modern "Daltonian" chemistry in a chapter entitled "The Delayed Scientific Revolution in Chemistry". In it he explores the tenacious attempt in the seventeenth century to explain chemical phenomena in terms reminiscent of Aristotle's views, inventing "phlogiston," which could never be clearly defined let alone isolated, to account for the metallic character of metals and the apparent escape of something during burning. Butterfield thought the chemical community was simply stubborn and wrong-headed, clinging to an old "thinking cap". Now we can begin to see that perhaps chemists were desperately trying to avoid the cold mechanical model that was so successfully sweeping physics.

IX

What I have tried to show in these pages is that there is struggling to be born a new view of the natural world and our relation to it. This new viewpoint will not be anti-science nor call for an end to industry, for both are integral and necessary parts of the life of the vast populations of today. Science and industry have brought deep new insights into man's power—admittedly for good or ill—and the directions by which many of man's problems may be tackled. But that, of course, is also the humanists' claim. What is missing in humanism is a way of harnessing the moral will to the accomplishment of what humanist reason so clearly sees. What we need is to forge a new link between the insights of science and the deeper promptings of the human spirit. And we will not be able to achieve this as long as the material world seems alien to us—as nails to pound with our tools. When we see nature no longer as nails to be pounded or bent but as flesh of our flesh and blood of our blood, whose handling will not only affect us directly by the feelings we

sense through our actions but also indirectly because every change we cause in nature will influence us and others now and in the future, for better or worse, then we will be moving to wholeness, to health. The environmental movement is pointing to the closed interconnectedness of our terrestrial spaceship, but it is not yet releasing that love which alone can adequately reverse present trends.

What we need is a rebirth of love for matter, becoming friends with the rocks, heeding Emerson's call. Those who most have that sense of oneness, of communion with materials today seem to be the craftswomen and craftsmen still active in all cultures from the most primitive to the most sophisticated. These learn from years of working with a given material what its properties are, its rhythms, how it may yield in the hands of a skilled and loving worker to serve our highest needs for beauty, use, inspiration, and direction.